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10/534540

PCT/EP2003/012613

JC20 Rec'd PCT/PTO 11 MAY 2005

Instrument panel for a motor vehicle  
having an airbag device  
integrated in a ventilation arrangement

### D e s c r i p t i o n

The invention relates to an instrument panel for a motor vehicle comprising of at least one ventilation outlet and a ventilation duct attached thereto and arranged behind the instrument panel, further comprising of an airbag module which is fastened behind the instrument panel and has a gas generator and a folded airbag arranged within its housing, wherein an outlet opening, which is closed by a covering that opens when the airbag module is triggered, is provided within the instrument panel for the unfolding airbag.

An instrument panel having the abovementioned characteristics is known from US 6 264 233. To the extent that an airbag module and a ventilation duct are arranged behind the instrument panel of a vehicle, there is provided a covering that covers both components and on the one hand forms the covering for the airbag module and on the other hand has integrated within itself a ventilation outlet having a ventilation cover covering the outlet, this ventilation cover being attached to the ventilation duct when the cover or ventilation outlet respectively is still in the position established within the instrument panel. The unfolding airbag presses the covering open when the airbag module is triggered,

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the ventilation outlet also releasing itself from the ventilation duct fastened to the instrument panel.

The known instrument panel and the fitting arrangement of ventilation duct and airbag module realized thereon has the disadvantage that a correspondingly large space is required for accommodating an airbag module behind the instrument panel and that the mutual covering for the ventilation duct and airbag module features substantial dimensions, this covering to be opened when a trigger occurs.

It is therefore the object of the invention to reduce the space requirement for the fitting arrangement of the airbag module behind the instrument panel in an instrument panel with the generic characteristics.

This object, including advantageous embodiments and further developments of the invention, is accomplished by the content of the claims that follow this description.

The basic idea of the invention provides for the airbag module to be arranged adjacent to the ventilation duct in such a manner that, when the airbag module is triggered, the airbag unfolds into the ventilation duct and from there unfolds out of the instrument panel through the ventilation outlet, the pressure of the unfolding airbag moving away the ventilation outlet arranged within the instrument panel. The invention has the advantage that the opening in the instrument panel, which is needed for ventilation anyway, is now also used for the escape of the airbag from the airbag module, so that

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it is possible to dispense with an extra openable covering provided in the instrument panel for the escape of the airbag. Since the ventilation duct is simultaneously used as an escape channel for the airbag when the airbag unfolds, a much more space-saving fitting arrangement of the airbag module behind the instrument panel is possible.

In one exemplary embodiment of the invention, it is provided that that housing wall of the airbag module that is adjacent to the ventilation duct forms a dividing wall for the duct and, when the airbag module is triggered, moves into the duct in such a manner that there is formed an escape channel leading from the airbag module to the ventilation outlet. In this exemplary embodiment, there remains open, within the wall enclosing the ventilation duct, a subregion that is closed by the assigned housing wall of the airbag module when the airbag module is installed.

Alternatively, it may be provided that the dividing wall of the ventilation duct adjacent to the airbag module forms a housing wall for the airbag module and that, when the airbag module is triggered, the mutual dividing wall / housing wall moves into the ventilation duct in such a manner that there is formed an escape channel leading from the airbag module to the ventilation outlet. In this embodiment, the mutual dividing and housing wall is assigned to the ventilation duct, so that it is possible to dispense with an additional wall on the housing of the airbag. This has the advantage that the required motion of the mutual dividing and housing wall into the ventilation duct may already be taken into consideration during the design and manufacture of the ventilation duct.

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In one exemplary embodiment of the invention, it is provided that the airbag module is arranged laterally next to the ventilation duct and that the dividing and housing wall swings into the ventilation duct around a fixed point located far from the instrument panel. In regard to the fitting arrangement of dividing and housing wall, it may here be provided that the ventilation outlet partially overlaps the airbag module and that that region of the dividing and housing wall that faces the instrument panel demonstrates a diagonal kink leading to that edge of the ventilation outlet located on the module side, the mutual dividing and housing wall running behind the ventilation outlet, wherein it may be further provided that the kink is dimensioned in such a manner that the kink fits into place on the opposite edge of the ventilation outlet during the swinging of said dividing and housing wall, thus forming and delimiting the escape channel for the unfolding airbag.

In an alternative embodiment, the invention provides that the airbag module is arranged on the side of the ventilation duct opposite the instrument panel.

To reduce the overall depth of the fitting arrangement of ventilation duct and airbag module behind the instrument panel in this embodiment, it may be provided that the airbag module is designed L-shaped with one section located laterally next to the ventilation duct and one section located on the side of the ventilation duct opposite the instrument panel, the mutual dividing and housing walls of the ventilation duct adjacent to the airbag module being integrally joined together and swinging into the ventilation duct when the airbag module is triggered.

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Since no direct opening in the instrument panel is any longer assigned as an escape hole for the airbag in any case, measures are provided in one exemplary embodiment of the invention to ensure that the airbag reliably unfolds out of the airbag module through the ventilation duct. For this purpose, it is provided that a partition wall arranged within the housing of the airbag module divides the airbag, which is folded into the housing, into two folding packages, one folding package being arranged adjacent to the ventilation outlet. In this case it may be advantageous for the folding package adjacent to the ventilation outlet to have a smaller dimension than the second folding package and act as a starting bubble for pulling out the second folding package when the airbag module is triggered. Depending on the structural factors, the invention also includes the idea that the fitting arrangement of a plurality of partition walls divides the folded airbag into a plurality of folding packages.

In regard to installing an airbag module onto the ventilation duct, it may be provided that a holding device attaches the airbag module to the ventilation duct and fastens it to the interior of the instrument panel.

In one exemplary embodiment of the invention, it is provided that a foil covers and holds the airbag in the vicinity where the airbag module is connected to the mutual dividing and housing wall, the airbag being folded into the housing and the foil tearing open when the airbag unfolds and lying down as protection between the airbag and the edges of the ventilation outlet.

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Since a very narrowly designed ventilation outlet may cause problems in regard to the speed at which the airbag unfolds, it is provided in one exemplary embodiment of the invention that predetermined breaking lines separate the vicinity of the instrument panel adjacent to the ventilation outlet from the rest of the instrument panel so that the unfolding airbag separates, from the instrument panel, both the separated region and the ventilation outlet acting as escape hole for the airbag. In this case, separating a specified area advantageously enlarges the escape hole for the airbag appropriately.

The drawing depicts exemplary embodiments of the invention, which will be described below. The drawing shows:

- Fig. 1            Longitudinal section of a subregion of an instrument panel having ventilation arrangement and airbag device prior to triggering of the airbag device,
- Fig. 2            the object of Figure 1 in a first stage of unfolding of the airbag as component of the airbag device,
- Fig. 3            the object of Figure 2 in an advanced stage of unfolding of the airbag,
- Fig. 4            another embodiment of the instrument panel having ventilation arrangement and airbag device in the representation depicted in Figure 1,

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- Fig. 5            the object of Figure 4 in a stage of partial unfolding of the airbag,
- Fig. 6            the object of Figure 1 in another embodiment,
- Fig. 7            the object of Figure 1 in another embodiment,
- Fig. 8a-c        the object of Figure 1 in different stages of installation of the airbag device on the ventilation duct and instrument panel.

Figure 1 depicts an instrument panel 11 contiguous to a windshield 10 of a motor vehicle in which an opening for both the ventilation outlet and escape of the airbag is arranged directed toward the windshield 10, so that in this fitting arrangement of the instrument panel both the ventilation duct and airbag module are underneath the instrument panel 11 relative to the windshield.

In particular, there is provided within the instrument panel a ventilation outlet 13, which is covered by a ventilation facing 14, which fits into the instrument panel 11 with positive fit. A ventilation duct 12, which is enclosed by walls 15 and for example spreads the air supply across the width of the vehicle underneath the instrument panel 11, is arranged underneath the ventilation outlet 13, the air supply being conveyed into the passenger compartment if necessary by a plurality of ventilation outlets 13 configured in the instrument panel 11.

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As still to be described in detail, an airbag module 16, within whose housing 17 a gas generator 19 and a folded airbag 18 are arranged, is arranged underneath the instrument panel 11 and directly adjacent to a ventilation duct 12. A partition wall 20 arranged in the housing 17 of the airbag module 16 divides the folded airbag 18 into 2 folding packages, and specifically into one folding package 21 directly adjacent to the ventilation outlet 13 and one folding package 22 arranged on the opposite side of the partition wall 20.

To the extent that the ventilation duct 12 and airbag module 16 hit one another because of their directly adjacent arrangement, there is provided a mutual dividing/housing wall 23 which, as a component of the walls 15 surrounding the ventilation duct 12, is connected to its assigned wall 15 of the ventilation duct 12 at a hinge-like connection 24 in such a manner that the pressure of the unfolding airbag 18 swings the mutual dividing and housing wall 23 into the ventilation duct 12 when the airbag module 16 is triggered.

In this case the mutual dividing and housing wall 23 is arranged relative to the ventilation outlet 13 in such a manner that the ventilation outlet 13 overlaps the mutual dividing and housing wall 23, wherein the region of this wall that faces the instrument panel 11 and is contiguous with the instrument panel 11 demonstrates a diagonal kink 25 leading to the edge of the ventilation outlet 13 running on the side of the airbag module 16, the dividing and housing wall 23 running behind the ventilation outlet 13. This kink 25 is dimensioned in such a manner, that the covering 25 fits into place on the opposite edge 26 of the ventilation outlet 13 when the mutual dividing and housing wall 23 swings into the ventilation duct 12,

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thus forming and delimiting an escape channel 40 for the unfolding airbag 18.

To the extent that the ventilation outlet 13 is closed by a ventilation facing 14, a rebound strap 28 holds the ventilation facing on the instrument panel 11 so that the ventilation facing 14 will not fly around the passenger compartment when instrument panel 11 releases the ventilation facing 14. The region of the ventilation facing 14 facing the airbag module 16 also demonstrates an air baffle 27 extending behind the instrument panel 11 to permit the ventilation facing 14 to open purposefully.

Figures 1 to 3 depict the triggering of the airbag module 16 in detail, Figure 2 showing that the gas released by the gas generator 19 when the gas generator is ignited first pressurizes the first folding package 21 facing the instrument panel 11, so that this folding package exerts a corresponding pressure on the mutual dividing and housing wall 23 toward the ventilation duct 12 and presses this mutual dividing and housing wall 23 around the hinge-like connection 24 inwards into the ventilation duct 12. At the same time, the folding package 21, which unfolds next, exerts a corresponding upwardly-directed pressure on the ventilation facing 14 because of the air baffle 27 located on the underside of the ventilation facing 14, so that the ventilation facing 14 swings open in the direction of the windshield 10 and releases the ventilation outlet 13 as unfolding hole for the airbag 18. In this respect, after the ignition of the gas generator 19, the first folding package 21 first acts as an extraction bubble that now pulls the second folding package 22 arranged

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underneath the partition wall 20 out of the housing 17 of the airbag module 16 during the further gas pressurization.

As not further illustrated, in the case of very narrow ventilation outlets 13 and 14, it may be provided that predetermined breaking lines separate, from the rest of the instrument panel 11, that region of the instrument panel 11 adjacent to the respective ventilation outlet and preferably surrounding the ventilation outlet, so that when the airbag module 16 unfolds, the unfolding airbag detaches both the region of the instrument panel 11 separated by predetermined breaking lines and the ventilation outlet from the instrument panel 11 so that an appropriately larger escape hole is formed for the airbag 18.

The exemplary embodiment that is depicted in Figure 4 and whose triggering is depicted in Figure 5 differs from the exemplary embodiment previously described in Figures 1 to 3 only in that the airbag module 16 is configured L-shaped, having one section 30 located laterally next to ventilation duct 12 and one section 29 located on the side of ventilation duct 12 opposite instrument panel 11, so that the airbag module 16 wraps partially around the ventilation duct 12. This realizes a particularly space-saving fitting arrangement of ventilation duct 12 and airbag module 16. Because of this design of airbag module 16, two wall sections of ventilation duct 12 each form adjacent mutual dividing and housing walls 23 which are integrally joined together and again swing into the ventilation duct 12 around a hinge-like connection 24 when the airbag module is triggered. Because the fitting arrangement of partition wall 20, which is again provided, is matched to the shape of airbag module 16,

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the design takes care that the first folding package, which the gas generator first pressurizes, acts as extraction bubble for the second unfolding package, as described in Figures 1 to 3.

Figures 6 and 7 depict exemplary embodiments of the invention in which the partition wall 20 or plurality of partition walls 20, respectively, provided in housing 17 of airbag module 16 form corresponding first, second or further folding packages in order to assure that the airbag 18 smoothly unfolds out of the airbag module 16 or ventilation duct 12, respectively, depending on the assignment of the airbag module 16 to the ventilation duct 12. Finally, Figures 8a-c show that simplified installation can be associated with the design of an instrument panel having ventilation arrangement and airbag device according to invention. Here the ventilation duct 12 and its assigned walls 15 and 23 are fastened to the instrument panel 11. In this case the ventilation duct 12 is provided with a mounting plate 32, which is arranged to accommodate the airbag module 16 and has an opening 33 built therein, wherein a projecting part 34 configured on the airbag module 16 is used to insert the airbag module into the opening 30 of the mounting plate 32 and, after the airbag module has been swung toward the mutual dividing and housing wall 23, it is fastened to the instrument panel 11 using a fastener 35. For this installation procedure, the airbag module 16 is provided with a cover layer 31 for the folded airbag 18 when it fits into place on the dividing and housing wall 23, which is mutual with the ventilation duct 12, this cover layer preferably being made of a welded-on foil that tears open from the pressure of the unfolding airbag. As evident from Figure 3, the foil may be configured in such a manner that it lies as protection between the

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airbag 18 and the edges of the ventilation outlet in particular when the airbag 18 unfolds, so that the fabric of the airbag 18 is treated gently and there is no danger that the fabric will tear.

The characteristics of the object of these documents disclosed in the above description, the claims, the abstract and the drawing may be essential for the realization of the invention in its various embodiments both individually and in any desired combination with each other.